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MARINE ALGÆ OF NEW BRUNSWICK.

HAY.

INTRODUCTORY LIST OF MARINE ALGÆ OF ATLANTIC CANADA, WITH NOTES.

HAY and MacKAY.

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XIV.—*Marine Algæ of New Brunswick. By* GEO. U. HAY. *With an Appendix containing a List of the Marine Algæ of the Maritime Provinces of the Dominion of Canada, with Notes. By* GEO. U. HAY, Ph. B., St. John, *and* A. H. MACKAY, B.A., B. Sc., F. S. Sc., Principal of Pictou Academy, N.S.

(Communicated by Mr. J. Fletcher, May 25, 1887.)

The following paper includes observations that have been made on the marine Algæ of New Brunswick during the past two years, together with some remarks on their economic value, the occurrence of some rare species, etc. The localities visited have been various points on the southern shore of New Brunswick, including the Island of Grand Manan, and the coasts of Caraquet and Tracadie, with the Islands of Shippegan and Miscou on the Gulf of St. Lawrence. To this is appended a preliminary list of the marine Algæ of the Maritime Provinces, which the writer, with the assistance of Mr. A. H. MacKay, of Pictou, has recently compiled for the Natural History Society of New Brunswick. The list includes some eighty species of marine Algæ, which, with the exception of an Introductory List of New Brunswick Algæ, published by the writer in 1886, is the first attempt to arrange our Algic flora in such a form as shall lead to a closer investigation of these interesting plants, and stimulate further study in this direction. No Diatomaceous or other microscopic forms are included in the subjoined list, but only those which may be easily detected by the eye, including chiefly the larger forms and those parasitic upon them. Of 130 species mentioned in Dr. Farlow's "Marine Algæ of New England," there have been observed, up to this time, on the shores of the Maritime Provinces, over eighty species.

The marine flora of the Maritime Provinces is essentially Arctic in character, as may be inferred from their boreal position and their exposure to cold currents from the Arctic seas. In the case of New Brunswick, the paucity of the more delicate species of Algæ may be accounted for chiefly in two ways:—

(1.) The action of the tides on the southern shore, as they sweep in and out of the Bay of Fundy, renders it impossible for any but the stronger forms to maintain themselves, except in sheltered coves, and such favored positions are rare on this coast. From one of these localities (Frye's Island) in the neighborhood of Passamaquoddy Bay over thirty species were collected in July, 1886.

(2.) The low sandy shores extending into the Gulf of St. Lawrence do not furnish a a favorable habitat for Algæ. A marked exception to this, however, was found on the northern shores of Miscou and Shippegan, just within Bay Chaleurs, where, at low-water mark, were detected several interesting species not observed on the southern shores. These are referred to in another part of this paper.

The Fuci and Laminariæ, which make up the great bulk of our Algæ, are distributed in abundance along the whole coast of New Brunswick. The Fuci occur between tide marks, and are found in this position in greatest abundance on the southern coast, where

the rocks for miles are clothed with them. On the sandy shores of the Gulf of St. Lawrence, the Fuci miss the rocks which afford them a substantial foothold, and are of rarer occurrence. The zone of the Laminariæ extends from low-water mark to several fathoms in depth. They occur in greatest profusion on the Gulf of St. Lawrence coast, where, after a southerly gale, vast masses thrown up by the waves may be observed for miles along the shore. On the southern coast their occurrence is somewhat rare for a considerable distance east and west of St. John, probably owing to the strength of the tides which sweep them from their resting-places. Towards the mouth of the bay, however, they occur in greater abundance.

Only two forms of Fucus are common on the coast of New Brunswick, viz., *Fucus nodosus* (*Ascophyllum nodosum*) and *F. vesiculosus*. These two species form nearly the whole covering of tidal rocks in the vicinity of St. John, and westward to Passamaquoddy Bay. Dr. Harvey, in his introduction to the "Nereis Boreali-Americana," remarks on the poverty of species of Fucus on the north-east coast of America, compared with the northern coasts of Europe. Of the four species found in abundance in Europe, two of these, *F. serratus* and *F. canaliculatus*, had not been found in America at the time of Harvey's visit in 1850. The latter has not yet occurred here. The former is mentioned in the supplement to the "Nereis" as having been found at Newburyport, Mass., but has not since been detected there or at any other point on the New England coast. A specimen of this plant, collected at Pictou by Rev. Prof. Fowler in 1869, is in the Natural History Society's Herbarium in St. John. It has not yet been reported from the New Brunswick coast. Two other species of Fucus occur here, confined as yet to a single locality for each, although they may be expected elsewhere, as Dr. Farlow describes them as common on the New England coast, viz., *F. evanescens* [1] found at Frye's Island, and *F. furcatus* just below low-water mark on the flat shores on the north-west side of Miscou Island. These two species have not yet been reported from Nova Scotia.

Although the Fuci are excellent fertilisers, very little use is made of them in that respect in New Brunswick. Near the southern coast of the province they are used to a limited extent on grass lands. I noticed some fine fields of grass on Grand Manan, last August, where these plants had been used as a top-dressing. Applied fresh to the land after the grass has been cut, and kept moist by the fogs which prevail there, they rapidly decompose and melt into the ground. The experience of those who have used them for fertilising purposes goes to prove that they yield the best results when used fresh. Their value as fertilisers is diminished, if used for other than grass crops; or if carted for any considerable distance from shore, owing to the expense of conveying so bulky a material. In some countries (Ireland and Scotland), crops of potatoes are raised by their means, but the crops thus yielded, though abundant, are of coarse and inferior quality. The ashes of the Fuci contain a large quantity of carbonate of soda; and Dr. Harvey states that they were once cultivated on the shores of Scotland, where rocks were deposited to attract them to sandy or pebbly shores. The total amount of revenue, says the same author, derived by the proprietors of these kelp shores on the coast of Scotland, during the eighty years from A.D. 1720 to 1800, was £595,000. But this trade was long since destroyed by obtaining

[1] Quite as common at Eastport as *F. vesiculosus*, for which it might be mistaken." Farlow's Marine Algæ of New England.

carbonate of soda more cheaply from other sources. As a source from which iodine is is obtained, however, it might be possible to utilise in future the enormous product of *Fucus vesiculosus* on the shores of the Maritime Provinces.

Of the Laminariæ there seem to be, so far as observed, only three species on the shores of New Brunswick. Their great variety of form and size renders the identification of species a matter of some difficulty to the student. The most generally diffused form, especially in the Gulf of St. Lawrence, is *Laminaria longicruris*. This, with species parasitical upon it, formed the great mass of marine vegetation observed in the long lines of seaweed cast up by the waves on the southern shores of Shippegan and Miscou. The length of one specimen of this plant, measured from hold-fast to end of blade, was 28 feet; and the stipe of another, which was all that could be obtained from the mass of debris in which it was imbedded, was 16 feet in length. Judging from the large size of this stipe, it must have belonged to a plant fully 30 feet long. Scattered in endless profusion along this shore, and thrown up from the deep water, were the beautiful forms of the bright red *Delesseria sinuosa* and *D. alata*, var. *angustissima*, the latter not having been yet observed on the southern coast of the province.

The other species of Laminariæ, *L. saccharina* and *L. digitata* with the related species, *Chorda filum*, *Agarum Turneri*, *Alaria esculenta*, are found to a much more limited extent on the shores of the Gulf of St. Lawrence than *L. longicruris*. The size of the latter among the islands at the mouth of the Bay of Fundy was much less than what was observed in the Gulf of St. Lawrence, and here it was replaced to a great extent by the other species of Laminariæ just mentioned.

The Laminariæ are valuable as fertilisers, although I am not aware that farmers in this province make any use of them. The stems of *Laminaria digitata* seem to be used for a variety of purposes, amongst others, for the manufacture of sponge-tents.

The only sea-plant that has a commercial value with us is *Rhodymenia palmata*, or dulse. During the season of 1886, the export of this seaweed from the shores of the Bay of Fundy was estimated, I am told, at upwards of 100 tons, of which about 50 tons were received and shipped from St. John. The selling price per lb. is from three to six cents delivered in St. John. The revenue from dulse gathered on the Bay of Fundy shores last year could not have fallen short of $10,000. The coast in the vicinity of Dark Harbor, and other points on the north-west side of Grand Manan, are favourite grounds for the collection of this seaweed. During the lull in the fishing season in August, many turn their attention to this industry. Much that is exported from St. John finds its way to the manufacturing towns in the New England States, where it seems to be in demand among the factory population.

Among the edible Algæ, that which occupies the highest place is *Chondrus crispus* (Irish moss). This when reduced to a jelly by boiling, and seasoned, is tolerably palatable, and has very nourishing qualities. *Porphyra laciniata* and *P. vulgaris*, as articles of food, are in considerable demand in China and on the west coast of Europe. These edible seaweeds are found in great abundance on the rocky shores of New Brunswick; but, either because no urgent necessity has arisen for their use, or because the attention of our people has not yet been directed to them, their qualities have so far been untested. But a knowledge of their value as food, as well as where to look for them and how to

recognise them, might, in the case of shipwrecked mariners, be of great value in sustaining life for a considerable time.

Among the rarer forms of Algæ that occur on our coast the following may be mentioned as worthy of notice :—

Ulothrix collabens, a small green Alga, found occurring at intervals on the inner shores of Miscou and Shippegan. This is a beautiful species, with tufted slender filaments of dark green, and does not occur on our southern shores, and but rarely in New England.

Odonthalia dentata, though found at various points on the Gulf of St. Lawrence, and on the southern shores of Nova Scotia and New Brunswick, has not yet been detected on the New England coast. It is a very attractive species, of a deep red color, and occurs on rocks and stones in deep water.

Polysiphonia fibrillosa, found on the north side of the Island of Miscou in considerable abundance, has hitherto been detected only at one place north of Cape Cod, referred to by Dr. Harvey in the "Nereis." It is one of the most beautiful species of Polysiphonia, and growing abundantly in tufts in shallow water, is a delicate and attractive form. Another species that is collected for its beauty, although not a rare species, is *Callithamnion Pylasœi*, which I detected at Grand Manan, although I have not observed it at any point east of that station. Its occurrence, as well as that of forms common on the New England coast, may be expected on further investigation.

List of the Marine Algæ of the Maritime Provinces, with Notes.

By G. U. Hay *and* A. H. MacKay.

Order I.—CRYPTOPHYCEÆ.

1. Clathrocystis roseo-persicina, *Cohn.* On mud in brackish pond, Pictou harbour, *MacKay ;* on decaying Algæ along shore of Gulf of St. Lawrence, *Hay.*
2. Oscillaria subtorulosa, *Bréb.* On floating balls of Polysiphonia, Pictou harbour *MacKay.*
3. Lyngbya majuscula, *Harv.* Pictou harbour, *MacKay.*
4. L. æstuarii, *Liebm.* In brackish pond, Pictou harbour, *MacKay.*

Order II.—ZOOSPOREÆ.

5. Ulva lactuca, (*Linn.*) *Le Jolis.* Pictou harbour, *MacKay.*
   (*a*). Var. rigida, (*Ag.*) *Le Jolis* and
   (*b.*) Var. lactuca, *Le Jolis*, are common in tide pools along the southern coast of New Brunswick, *Hay.*
   (*c.*) Var. latissima, *Le Jolis.* Richibucto River, *Fowler.* Common in brackish waters along the whole coast of New Brunswick, *Hay.*

6. U. ENTEROMORPHA, *Le Jolis*, also
   (*a.*) Var. LANCEOLATA, *Le Jolis*, and
   (*b*). Var. COMPRESSA, *Le Jolis*. Pictou harbour, *MacKay*; Frye's Island, St. John, *Hay*.
   (*c*). Var. INTESTINALIS, *Le Jolis*. Very common, Richibucto River, *Fowler*; St. John, *Hay*.

7. U. CLATHRATA, *Ag*. On *Zostera marina*, Pictou, *MacKay*; Miscou Island, *Hay*.

8. U. HOPKIRKII, (*McCalla*) *Harv*. Pictou Harbour, *MacKay*.

9. ULOTHRIX COLLABENS, (*Ag*.) *Thur*.? Grand Manan, *Hay*.

10. CHÆTOMORPHA MELAGONIUM, (*Web. & Mohr*.) *Kutz*. Halifax harbour, *MacKay*.

11. C. PICQUOTIANA, (*Mont*.) *Kutz*. Halifax, *Harvey* in "Nereis Boreali-Americana."

12. RHIZOCLONIUM TORTUOSUM, *Kutz*. Halifax, *Harvey* in N.B.-Am.; Shippegan Island, *Hay*.

13. CLADOPHORA ARCTA, (*Dillw*.) P. E. Island, *Dr. Jeans*; Halifax, *Harvey*; Grand Manan and Frye's Island, *Hay*.

14. C. LANOSA, (*Roth*) *Kutz*, var. UNCIALIS, *Thuret*. P. E. Island, *Jeans*; Halifax, *Harvey*.

15. C. RUPESTRIS, (*Linn*.) *Kutz*. Shippegan Island, *Hay*.

16. C. REFRACTA, (*Roth*.) *Areschoug*. Frye's Island, *Hay*.

17. C. GLAUCESCENS, (*Griff*.) *Harv*. Halifax, *Harvey*; North Miscou, *Hay*.

18. C. FLEXUOSA, (*Griff*.) *Harv*. Miscou Island, *Hay*.

19. C. GRACILIS, (*Griff*.) *Kutz*. Frye's Island, *Hay*.

20. PHYLLITIS FASCIA, *Kutz*. Halifax, *Harvey*.

21. SCYTOSIPHON LOMENTARIUS, *Ag*. Halifax, *MacKay*; Frye's Island, Caraquet, Grand Manan, *Hay*.

22. PUNCTARIA LATIFOLIA, *Grev*. Halifax, *Harvey*. Var. ZOSTERÆ, *Le Jolis*. Mouth of Pictou harbour, *MacKay*.

23. P. PLANTAGINEA, (*Roth*) *Grev*. P. E. Island, *Jeans*.

24. DESMARESTIA ACULEATA, *Lamx*. Pictou, *MacKay*; Kouchibouguac Bay, *Fowler*.

25. D. VIRIDIS, *Lamx*. Halifax, *Harvey*; Frye's Island, Grand Manan, Miscou, *Hay*.

26. DICTYOSIPHON FŒNICULACEUS, *Grev*. Pictou, *MacKay*. This species has been found growing as regular branches from a stem formed of the filiform frond of *Chordaria flagelliformis*, at Pictou, in such a manner that the whole appeared to be but one plant. The conundrum was: How can the microscopic section of the branch shew the structure of Dictyosiphon, while that of the stem shews with equal distinctness the structure of Chordaria? Further examination, of course, demonstrated the character of the interesting union. Frye's Island, Grand Manan, Miscou, *Hay*; Kouchibouguac Bay, *Fowler*.

27. ECTOCARPUS TOMENTOSUS, (*Huds*.) *Lyngb*. P. E. Island, *Jeans*.

28. E. CONFERVOIDES, (*Roth.*) *Le Jolis.* P. E. Island, *Jeans.* Var. SILICULOSUS, *Kjellman.* Pictou, *MacKay;* Frye's Island, Caraquet, Miscou, *Hay.*

29. E. LITTORALIS, *Lyngb.* Pictou, *MacKay;* Grand Manan, Miscou, Shippegan, *Hay.*

30. E. FASCICULATUS, *Harv.* Caraquet Bay, *Hay.*

31. E. BRACHIATUS, *Harv.* P. E. Island, *Jeans.*

32. ECTOCARPUS, sp. A still undefined species. Shippegan Island, *Hay.*

33. ELACHISTEA FUCICOLA, *Fries.* Pictou, *MacKay;* Halifax, *Harvey;* Frye's Island, Miscou, Grand Manan, *Hay.*

34. LEATHESIA DIFFORMIS, (*Linn.*) *Areschoug.* Halifax, *Harvey.*

35. CHORDARIA FLAGELLIFORMIS, *Ag.* Pictou, *MacKay;* Halifax, *Harvey;* Frye's Island, Caraquet, *Hay.*

36. MESOGLOIA DIVARICATA, *Kutz.* Pictou, *MacKay;* Frye's Island, *Hay.*

37. M. VERMICULARIS, *Ag.* Halifax, *Harvey.*

38. CASTAGNEA ZOSTERÆ, (*Mohr.*) *Thuret.* Halifax, *Harvey.*

39. CHORDA FILUM, *Linn.* Pictou, *MacKay;* Frye's Island, Gulf Shore, *Fowler, Hay.*

40. LAMINARIA LONGICRURIS, *De la Pyl.* Halifax, *MacKay* and *Harvey.* Stipes three or four yards long have been observed. Prof. Lawson, of Dalhousie College, says that on taking charge of chemistry on his arrival at Halifax he could get no rubber tubing in the city. While his order was coming, he used the hollow stipes of this seaweed, which is always cast up in abundance on the Halifax coast, and found it to answer splendidly for the conduction of gas, *MacKay.* Around Grand Manan and the southern coast of New Brunswick the forms of Laminariæ are variable and confusing, the two following species (*L. saccharina* and *L. digitata*) being most abundant, *Hay.*

41. L. SACCHARINA, (*Linn.*) *Lamx.*? Pictou, *MacKay;* Halifax, *Prof. Lawson;* Frye's Island, Grand Manan, *Hay;* Gulf of St. Lawrence, *Fowler.*

42. L. DIGITATA, *Lamx.* Pictou, *MacKay;* Halifax, *Harvey, Lawson;* Grand Manan, *Hay.*

43. SACCORHIZA DERMATODEA, *De la Pyl.* Halifax, *Harvey;* Grand Manan, *Hay.*

44. AGARUM TURNERI, *Post.* and *Rupr.* Halifax, *MacKay, Harvey, Lawson;* Grand Manan and Frye's Island, *Hay.*

45. ALARIA ESCULENTA, *Grev.* Halifax, *MacKay, Harvey, Lawson;* Grand Manan, *Hay.* This species is used as food in Scotland and Ireland, where it is called badder-locks, henware, murlins, and also in Iceland, but it is not eaten with us, *Dr. Farlow.*

Order III.—OOSPOREÆ.

46. ASCOPHYLLUM NODOSUM, *Le Jolis.* Pictou, *MacKay;* Halifax, *MacKay* and *Harvey;* very common on southern coast of New Brunswick, *Hay, Fowler.*

47. FUCUS VESICULOSUS, *L.* Pictou and Halifax, *MacKay;* Halifax, *Harvey.* The varieties of this species are very abundant between tide marks on the southern shores of New Brunswick, *Hay;* Gulf shore, *Fowler.*

48. F. SERRATUS, *L.* Pictou, *Fowler;* Pictou and Pictou Island, *MacKay.* Not found elsewhere in N. E. America.

49. F. EVANESCENS, *Ag.* Frye's Island, Grand Manan, *Hay.*

50. F. FURCATUS, *Ag.* Growing on the low, flat shores north-west side of Miscou Island, beyond low-water mark, *Hay.*

51. VAUCHERIA (?) Pictou, *MacKay.*

Order IV.—FLORIDEÆ.

52. PORPHYRA LACINIATA, *Ag.* Pictou, *MacKay;* Halifax, *Harvey;* Frye's Island and Grand Manan, *Hay.*

53. BANGIA FUSCO-PURPUREA, *Lyngb.* Halifax, *Harvey.*

54. CALLITHAMNION ROTHII, *Lyngb.* Halifax, *Harvey.*

55. C. PYLAISÆI, *Mont.* Southern Head, Grand Manan, washed ashore in great abundance at the base of the cliffs, *Hay.*

56. C. AMERICANUM, *Harv.* P. E. Island, *Jeans;* Halifax, *Harvey.*

57. C. CORYMBOSUM, *Lyngb.* Halifax, *Harvey.*

58. PTILOTA ELEGANS, *Bonnem.* P. E. Island, *Jeans.*

59. P. SERRATA, *Kutz.* Halifax, *Harvey;* Grand Manan, Frye's Island, Shippegan, *Hay.*

60. CERAMIUM RUBRUM, *Ag.* Very abundant. Pictou and Halifax, *MacKay;* Frye's Island, Shippegan, *Hay;* Kouchibouguac Bay, *Fowler.* Var. PROLIFERUM, *Ag.* Little Shippegan Bay, *Hay.*

61. C. CIRCINNATUM, *Kutz.* Little Shippegan Bay, *Hay.*

62. C. TENUISSIMUM, (*Lyngb.*) *Ag.* Pictou, *MacKay.*

63. HALOSACCION RAMENTACEUM, (*L.*) *Ag.* Halifax, *MacKay;* Frye's Island, *Hay.*

64. PHYLLOPHORA BRODLÆI, *Ag.* Halifax, *Harvey.*

65. AHNFELDTIA PLICATA, *Fries.* Pictou and Halifax, *MacKay;* Caraquet, Frye's Island, *Hay;* Gulf of St. Lawrence, *Fowler.*

66. CYSTOCLONIUM PURPURASCENS, *Kutz.* Halifax, *MacKay;* Miscou Island, *Hay.*

67. CHONDRUS CRISPUS, (*Linn.*) *Stack.* Pictou and Halifax, *MacKay;* Meogone Island, Frye's Island, *Hay;* Gulf of St. Lawrence, *Fowler.*

68. RHODYMENIA PALMATA, (*Linn.*) *Grev.* Pictou and Halifax, *MacKay.* Very abundant on the Gulf shore and southern coast of New Brunswick, *Fowler, Hay.* This and *Chondrus crispus* are the only seaweeds on our coasts collected for edible purposes.

69. RHODOPHYLLIS VEPRECULA, *J. Ag.* Halifax, *Harvey;* Grand Manan, *Hay.*

70. EUTHORA CRISTATA, *J. Ag.* Halifax, *Harvey;* Grand Manan, *Hay.*

71. POLYIDES ROTUNDUS, *Grey.* Pictou and Halifax, *MacKay.*

72. DELESSERIA SINUOSA, *Lamx.* Halifax, *Harvey;* Frye's Island, Miscou, *Hay.*

73. D. ALATA, *Lamx.*, var. ANGUSTISSIMA, *Harv.* Very abundant on south side of Miscou and Shippegan Islands, where it is cast ashore with the larger seaweeds, *Hay.*

74. GRACILLARIA MULTIPARTITA, *J. Ag.* Pictou, *MacKay;* Kouchibouguac Bay, *Fowler.*

75. ODONTHALIA DENTATA, *Lyngb.* Halifax, *Harvey;* Pictou, *MacKay;* Kouchibouguac Bay, *Fowler;* Shippegan and Miscou, *Hay.* Not reported south of the Maritime Provinces.

76. RHODOMELA SUBFUSCA, *Ag.* Halifax, *MacKay;* Frye's Island, Grand Manan, Miscou, *Hay.* Var. GRACILIOR, *J. Ag.* Kouchibouguac Bay, *Fowler.*

77. POLYSIPHONIA URCEOLATA, (*Dillw.*) *Grev.* Halifax, *Harvey;* P. E. Island, *Jeans;* Pictou, *MacKay;* Miscou and Shippegan, *Hay.* Var. FORMOSA, *Ag.* P. E. Island, *Jeans.*

78. P. OLNEYI, *Harv.* Pictou and Halifax, *MacKay.*

79. P. HARVEYI, *Bailey* (?). Pictou, *MacKay.*

80. P. FIBRILLOSA, *Grev.* North Miscou, *Hay.*

81. P. VIOLACEA, *Grev.* Halifax, *Harvey;* P. E. Island, *Jeans;* Pictou, *MacKay;* Kouchibouguac Bay, *Fowler.* Common along the whole coast of New Brunswick, *Hay.*

82. P. NIGRESCENS, *Grev.* Halifax, *Harvey;* P. E. Island, *Jeans;* Pictou, *MacKay.* Var. FUCOIDES, *Ag.* Caraquet beach, Miscou gully, *Hay.*

83. P. FASTIGIATA, *Grev.* Pictou and Halifax, *MacKay;* Frye's Island, *Hay.*

84. CORALLINA OFFICINALIS, *L.* Halifax, *Harvey.* Common on southern and eastern coasts of New Brunswick, and usually found on shells thrown ashore by the waves, *Fowler, Hay;* Minas Basin, *MacKay.*